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## CORRESPONDENCE

## "A SIMPLE DYNAMOMETER"

In the first number of *TORREYA*, Dr. H. M. Richards describes briefly "a very simple machine for registering approximately the amount of energy involved" in imbibition.\* Passing over the terms here used (to which the physicist would take serious exception), it is obvious that the force of imbibition cannot be measured by the arrangement described. Dr. Richards has apparently confused the *force* of imbibition with the *extent* of swelling. The attraction in virtue of which water is imbibed, being probably molecular or analogous thereto, is not dependent on the number of organized structures (such as cell-walls) involved, but the extent of the swelling is. The scale in the arrangement suggested registers not force but *distance in terms of weight*. To illustrate: If the bottle contained only one layer of peas the scale might register a quarter of an ounce, since the distance through which the pan would be depressed might equal the depression which that weight would cause in the particular spring used (a weak one). If the bottle were nearly filled, however, and the peas did not jam but moved freely upward as they swelled, the scale might register half a pound. Yet the actual force of imbibition in the two cases would be exactly the same, and vastly greater than either registration. Evidently also the result would be wholly different with a very strong spring, an equal depression corresponding perhaps to 100 lbs.

The same objection would lie against the use of the scale for measuring the force exerted in growth.

It may be worth while, further, to call attention to the fact that a like error inheres in all methods of measuring the force of root-pressure in decapitated plants when a large open tube is used as a manometer.† To a less extent this objection applies also to open mercury manometers.—C. R. BARNES, *University of Chicago*.

\* Richards, H. M. A simple Dynamometer. *Torrey*, 1: 8. Ja. 1901.

† Atkinson. *Elem. Bot.* 32, and *Lessons in Botany*, 51. Here, regarding a device recommended by Detmer merely to demonstrate the outflow of sap, it is said, "The height of this column of water is a measure of the force exerted by the roots."